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NHC Reference No. 3003900
July 21, 2025

Ausenco Engineering Canada Inc.
1050 West Pender St, Suite 1200
Vancouver, BC V6E 3S7

Attention: Rob Gardner, P.Eng, Senior Project Manager
Via email: rob.gardner@ausenco.com

Re: **Woodfibre LNG – Floatel #2**
Henriette Dam Breach Impacts Assessment Memorandum (Final) Rev. 0

Dear Mr. Gardner:

Please find a high-level summary of NHC's assessment of potential impacts of a hypothetical breach of Henriette Lake Dam on the new, second floatel and access barge proposed to be moored south of the Woodfibre LNG facility currently under construction.

1 INTRODUCTION

The Woodfibre LNG facility near Squamish, BC is to be located on the previous site of the Woodfibre facility in Howe Sound. A floatel (floating work camp) is currently moored on site to the north of the mouth of Woodfibre Creek to house workers during construction of the new LNG facility. A second floatel (floatel #2) has recently been proposed for implementation south of the existing floatel to house additional workers during construction of the Woodfibre LNG facility.

Ausenco (on behalf of Woodfibre LNG) retained Northwest Hydraulic Consultants Ltd. (NHC) in 2020 to conduct dam breach, inundation, and consequence classification analyses for the Henriette Lake Dam, which releases flows via Woodfibre Creek into Howe Sound, just south of the Woodfibre LNG site. As part of the dam breach analysis, depth variations and velocities were estimated in Howe Sound near the shoreline at the project site using a 2D flood routing model. This data was used to help assess the potential impacts to proposed infrastructure to be constructed as part of the LNG facility, including the first floatel (floatel #1) that was originally proposed to be moored to the South of Woodfibre Creek (but is now moored north of Woodfibre Creek).

Figures 1.1 and 1.2 show that floatel #2 would be moored in direct path of the mouth of Woodfibre Creek, where the depth is approximately 20 m. NHC understands that during recent discussions amongst Woodfibre LNG and their contractors, questions have been raised regarding the impacts to the proposed floatel #2 and its access barge in the event of a hypothetical dam breach of Henriette Lake Dam if the vessel were to be moored at the currently proposed location.

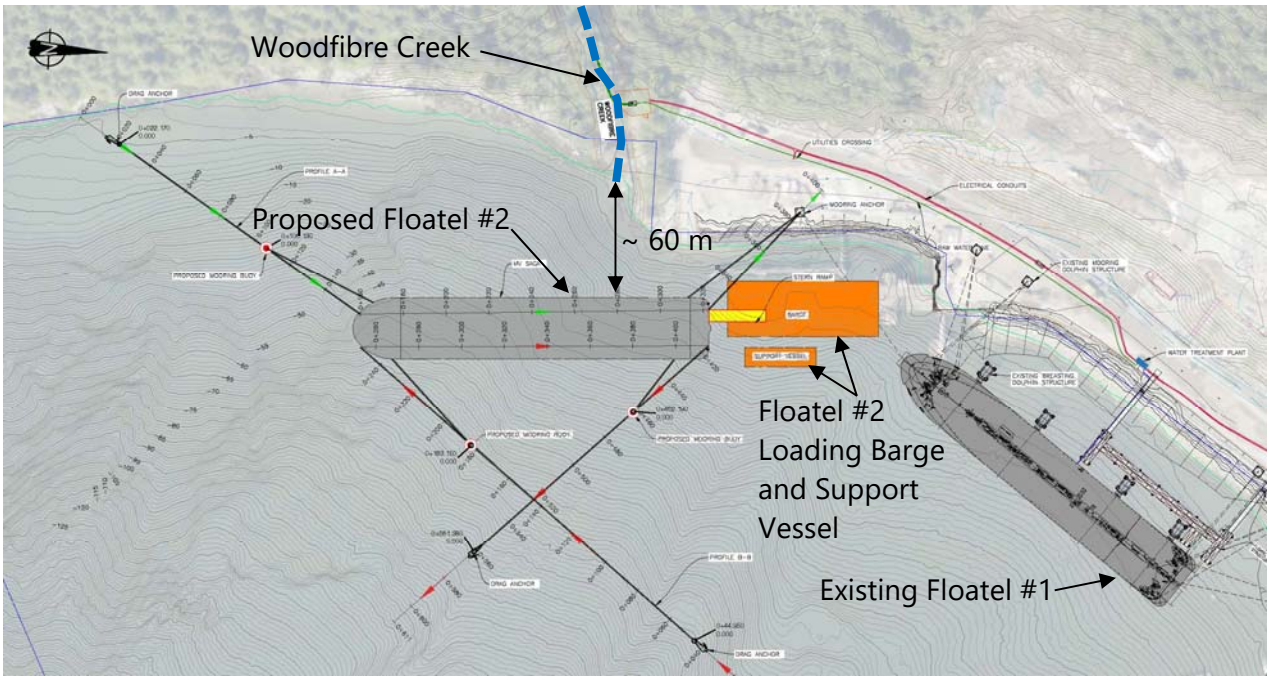

Figure 1.1 Proposed Floatel #2 Location - Plan *(image source: Woodfibre LNG)*

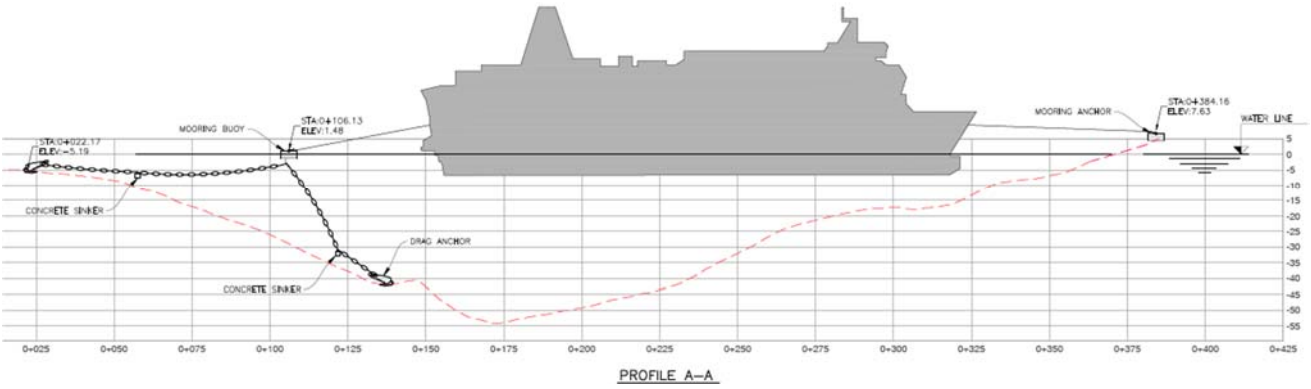

Figure 1.2 Depths in Howe Sound at Proposed Floatel #2 Location *(image source: Woodfibre LNG)*

Ausenco (on behalf of Woodfibre LNG) has engaged NHC to assess the impacts of a breach of Henriette Lake Dam on the proposed floatel #2 and its access barge based on the results of NHC's previous dam breach and inundation modelling (NHC, 2022). Our assessment is summarized below, with the intent that Woodfibre LNG, their prime contractor, and/or contractor of the proposed floatel #2 can use the information presented in this memorandum to assess the level of risk to the vessel and access barge at the currently proposed location.

2 EXISTING MODEL DATA

A summary of relevant data obtained from previous NHC modelling completed for the project is provided in the following sub-sections.

2.1 Henriette Lake Dam Breach Modelling

As presented in Section 1, NHC previously assessed depth variations and velocities along Woodfibre Creek and within Howe Sound in the vicinity of the Woodfibre LNG site's shoreline using a 1D dam breach model and 2D flood routing model as part of the 2020 Henriette Lake Dam Breach and Consequence Classification analyses (NHC, 2022).

For the purposes of the current assessment, Woodfibre LNG has requested that these dam breach results within Howe Sound be reviewed for the sunny-day dam breach condition (i.e. dam failure that occurs during normal operations that may be caused by a seismic event, internal erosion, or other events). The sunny-day dam breach model conservatively assumed that the reservoir level was at the crest of the spillway at the onset of the breach.

Locations of the selected observation points for which depth variations and velocity data exists near the Woodfibre LNG site are presented in Figure 2.1. The observation points were selected in 2020 based on proposed locations of key infrastructure at the Woodfibre LNG site at the time, including the originally proposed location for floatel #1. As shown in Figure 2.1, the observation points closest to the proposed floatel #2 and access barge are:

- P1 - located near the mouth of Woodfibre Creek, approximately 100 m upstream, of the North end of the proposed floatel #2 (note that this observation point represents the location of the access bridge to the originally proposed floatel #1 location)
- P2 - located approximately 70 m west of the south end of the proposed floatel #2
- P3 - located approximately 70 m southwest of the south end of the proposed floatel #2
- P7 - located near the south end of the proposed access barge for floatel #2
- P8 - located near the north end of the proposed access barge for floatel #2

2.2 Howe Sound Wind-Wave Modelling

Knight Piésold Ltd. (on behalf of Woodfibre LNG) engaged NHC in 2022 to estimate the 1:200 year wind-generated waves in Howe Sound near the project's shoreline to support the design of the marine structures and to provide planning estimates for the Flood Construction Level (FCL) at the project site.

The 1:200 year significant wave heights presented in NHC (2023) were reviewed as part of this assessment and compared to depth variations in Howe Sound resulting from a breach of Henriette Lake Dam to help illustrate the relative scale of the potential dam breach impacts. Locations of the selected observations points for which NHC's wind-wave data exists near the project site are presented in Figure 2.1. While wind-wave data does not extend south of Woodfibre Creek at the location of the proposed floatel #2, NHC considered wind-wave data at observation points W1, W2, and W3 (near the current location of floatel #1). As shown in Figure 2.1, observation point W1 is located a short distance from the north end of the access barge to floatel #2.

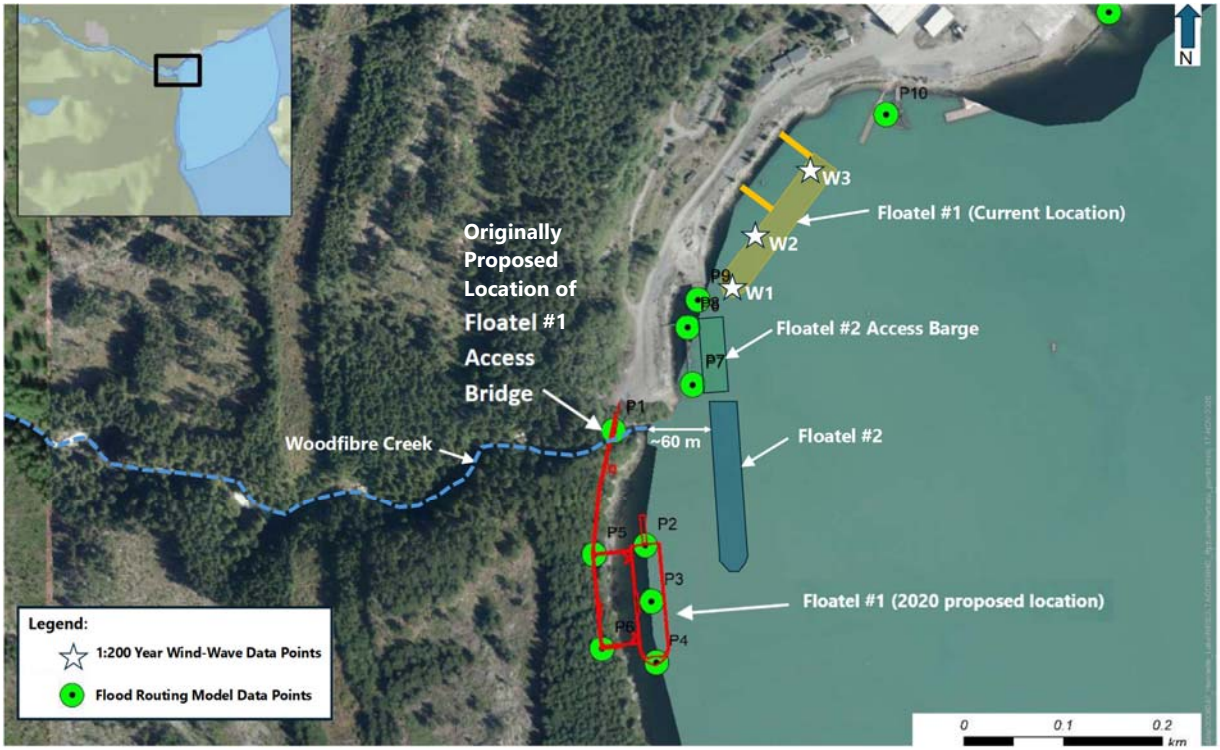

Figure 2.1 Available flood routing and wind-wave modeling observation points in the vicinity of the floatel #2.

3 FLOATEL #2 IMPACT ASSESSMENT

3.1 Henriette Lake Dam Breach Modelling

Table 3.1 presents the maximum variation in depths and velocities at select locations near the mouth of Woodfibre Creek and within Howe Sound. Figures 3.1 to 3.5 present time series of depths at key locations near the mouth of Woodfibre Creek and within Howe Sound. Figures 3.6 to 3.10 present time series of velocities at select locations near the mouth of Woodfibre Creek and within Howe Sound.

Table 3.1 Summary of Maximum Depth Variations and Maximum Velocities in Woodfibre Creek and Howe Sound Resulting from Sunny-Day Breach of Henriette Lake Dam.

Observation Points[1]	Initial Depth[2,3] (m)	Maximum Depth Increase Resulting from Dam Breach[3] (m)	Maximum Velocity resulting from Dam Breach (m/s)
P1	0.4	6.6	12.3
P2	7.5	0.9	1.3
P3	6.1	0.7	0.9
P7	7.4	1.2	1.8
P8	4.0	0.9	2.1

1. See Figure 2.1 for locations of observation points.
2. Initial depth refers to depth prior to flood wave arrival from a breach of Henriette Lake Dam.
3. Modelled initial depths based on a Higher High Water Mean Tide (HHWMT) level of El. 1.97 m which was conservatively adopted for the 2022 dam breach Inundation model.

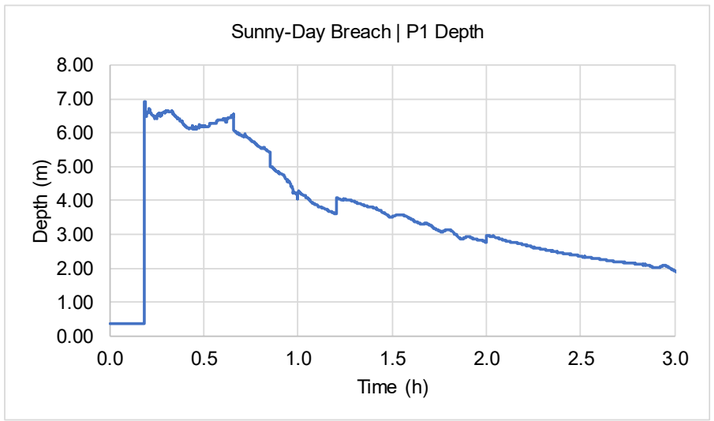

Figure 3.1 Depth variation in Woodfibre Creek at P1 resulting from a Sunny-Day Breach of Henriette Lake Dam.

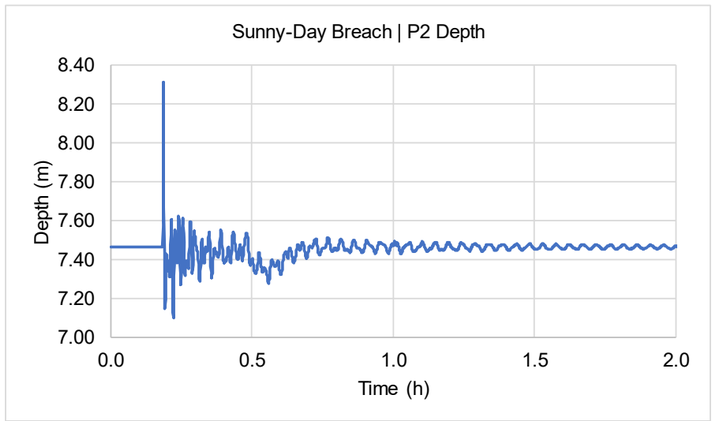

Figure 3.2 Depth variation in Howe Sound at P2 resulting from a Sunny-Day Breach of Henriette Lake Dam.

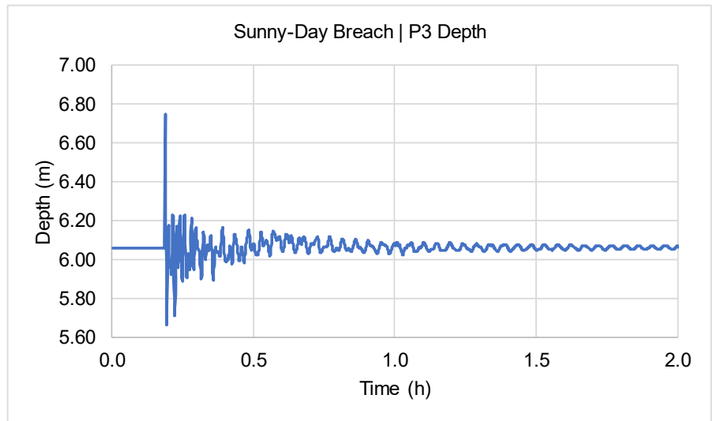

Figure 3.3 Depth variation in Howe Sound at P3 resulting from a Sunny-Day Breach of Henriette Lake Dam.

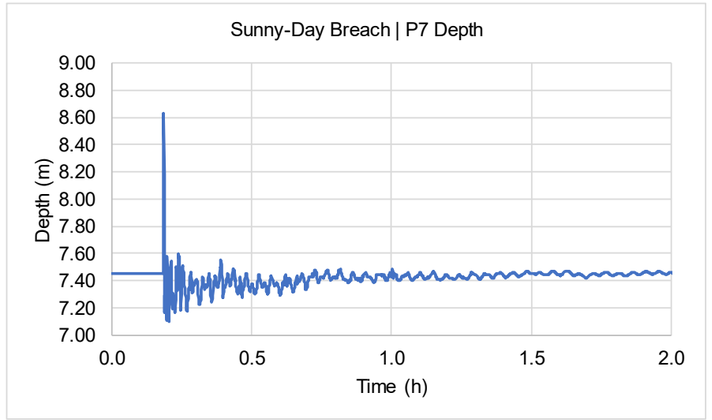

Figure 3.4 Depth variation in Howe Sound at P7 resulting from a Sunny-Day Breach of Henriette Lake Dam.

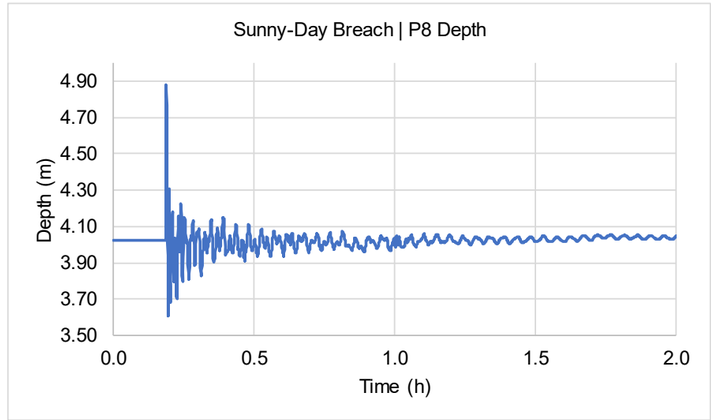

Figure 3.5 Depth variation in Howe Sound at P8 resulting from a Sunny-Day Breach of Henriette Lake Dam.

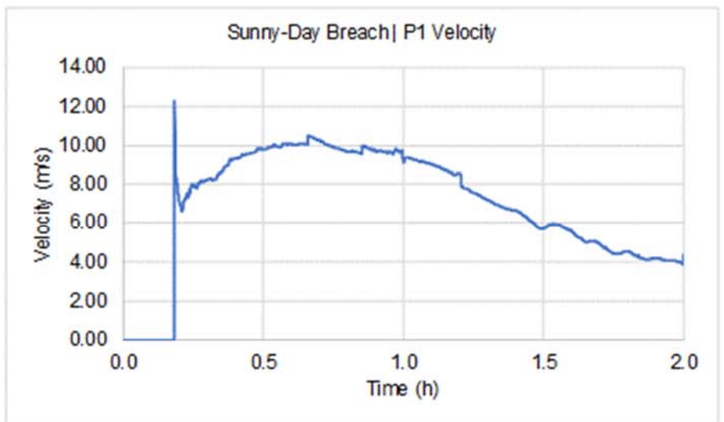

Figure 3.6 Velocity variation in Woodfibre Creek at P1 resulting from a Sunny-Day Breach of Henriette Lake Dam.

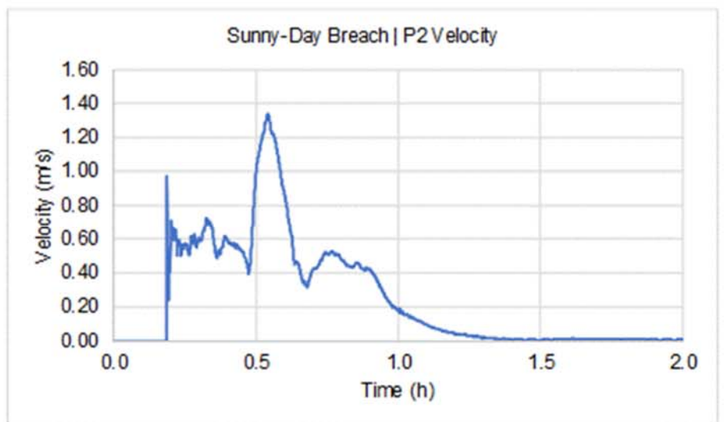

Figure 3.7 Velocity variation in Howe Sound at P2 resulting from a Sunny-Day Breach of Henriette Lake Dam.

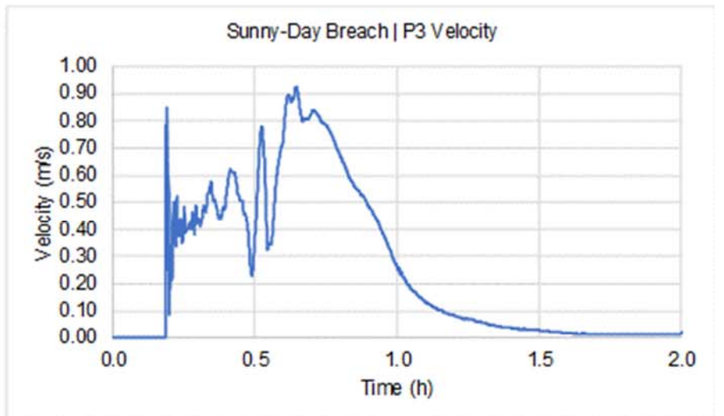

Figure 3.8 Velocity variation in Howe Sound at P3 resulting from a Sunny-Day Breach of Henriette Lake Dam.

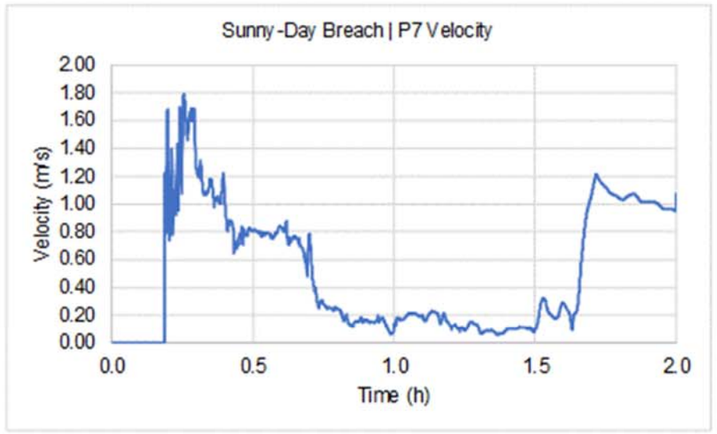

Figure 3.9 Velocity variation in Howe Sound at P7 resulting from a Sunny-Day Breach of Henriette Lake Dam.

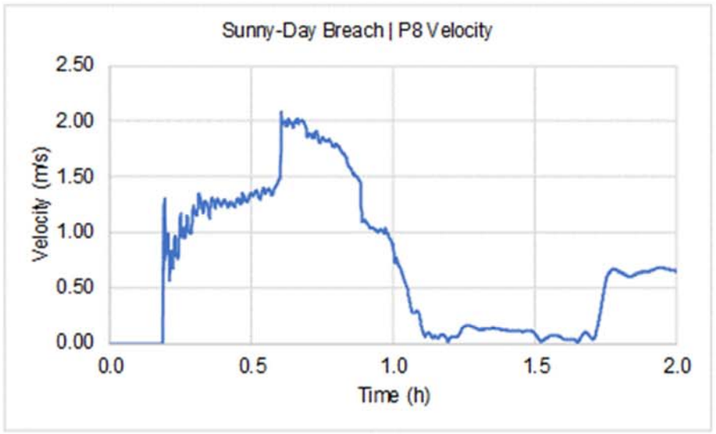

Figure 3.10 Velocity variation in Howe Sound at P8 resulting from a Sunny-Day Breach of Henriette Lake Dam.

The results of the dam breach and inundation modelling presented above indicate that a sunny-day breach of Henriette Lake Dam would result in an approximately 6.5 m high flood wave with a maximum velocity of approximately 12 m/s entering Howe Sound from Woodfibre Creek (observation point P1). However, model data within Howe Sound suggests that the breach wave attenuates rapidly and does not result in any significant wave activity at the evaluated observation points. Specifically, the initial depth increase[1] within Howe Sound reached up to approximately 0.9 m southwest of the mouth of the Woodfibre Creek (P2) with maximum velocity of approximately 1 m/s, and up to approximately 1.2 m to the northeast of the mouth of the Woodfibre Creek (P7, near the floatel #2 access barge) with a maximum velocity of approximately 2 m/s. Although the 2020 flood routing model did not include observation points at the location of floatel #2, interpolation of modelled water surface elevations downstream of the mouth of Woodfibre Creek suggest that the flood wave resulting from a sunny-day breach of Henriette Lake Dam would attenuate to approximately 0.5 m at a location approximately 75 m downstream from the mouth of Woodfibre Creek (which corresponds to roughly the centreline of floatel #2). This small increase in depth (relative to the depth increases at the selected dam breach inundation model observation points) is likely mostly attributable to the greater water depth at the location of the vessel (ie. the proposed location for floatel #2 is further offshore from the observation points). Note that the initial depths within Howe Sound at the observation points presented in Table 3.1 generally range from approximately 4.0 m to 7.5 m, which are significantly lower than the depths at the proposed location of floatel #2. As presented in Figure 1.2, depths near the shore side (West side) of the vessel range from approximately 17 m at the North end of the vessel, to approximately 47 m at the South end of the Vessel (based on a HHWMT level of El. 1.97 m, which was assumed for the dam breach inundation modelling). The approximate depth at the location of the vessel that is inline with the mouth of Woodfibre Creek appears to be approximately 22 m.

3.2 Howe Sound Wind-Wave Modelling

A review of NHC's 2022 wind-wave model results just offshore of the project site (NHC, 2023) indicates that the 1:200 year significant wave heights just north of the floatel #2 access barge are generally double the estimated depth increases that would result from a breach of Henriette Lake Dam (Table 3.1). As presented in Table 3.2, the maximum 1:200 year significant wave height at observation point W1 (located just north of the proposed floatel #2 access barge is 1.7 m).

[1] Refers to the maximum depth increase as the dam breach flood wave reaches each observation point.

Table 3.2 Summary of the 1:200 year wind-generated significant wave heights

Observation Point[1]	H_{sig} (m)	
	Southeasterly Waves	Northeasterly Waves
W1	**1.6**	**1.7**
W2	1.7	1.6
W3	1.8	1.5

1. See Figure 2.1 for locations of observation points.

4 SUMMARY

This assessment reviewed the potential impacts of a sunny-day breach of Henriette Lake Dam within Howe Sound near the proposed floatel #2 and access barge location. The information presented herein is intended to support Woodfibre LNG, their prime contractor, and/or contractor of the proposed floatel #2 in their assessment of the level of risk to the vessel, including its access barge, mooring boys, and shore anchoring.

While previous dam breach and inundation modelling indicates that a hypothetical breach of Henriette Lake Dam would result in a large, high-velocity flood wave conveyed along Woodfibre Creek, model data indicates that the flood wave attenuates relatively rapidly upon entering Howe Sound. Although the dam breach inundation model does not include observation points at the location of the proposed floatel #2 (and access barge), nearby observation points closer to the shoreline suggest that a hypothetical breach of Henriette Lake Dam would result in depth increases of approximately 1 m, with maximum velocities of approximately 1 to 2 m/s. The modelled increases in depths within Howe Sound are generally half of the previously documented 1:200 year significant wind-wave heights in the area. Furthermore, interpolation of available dam breach inundation model data suggests that the breach wave may attenuate to approximately 0.5 m near the location of floatel #2 that is directly inline with the mouth of Woodfibre Creek, where depths exceed 20 m.

CLOSURE

We hope this submittal meets your current needs. Please do not hesitate to contact Kirsten Blezy (KBlezy@nhcwater.com; 250-754-6425) or Nancy Sims (NSims@nhcwater.com; 604-969-3002) if you have any questions or require any additional information.

Sincerely,

Northwest Hydraulic Consultants Ltd.

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Associate

Reviewed by:

Nancy Sims, PEng
Principal

EGBC Permit to Practice Number: 1003221

REFERENCES

NHC (2022), "Henriette Lake Dam – Dam Breach and Consequence Classification Analyses, Final Report", October 27, 2022.

NHC (2023), "Woodfibre LNG Site Redevelopment Coastal Flood Hazard Assessment, Final Report, Rev 1", May 18, 2023.

DISCLAIMER

This report has been prepared by Northwest Hydraulic Consultants Ltd. for the benefit of Ausenco Engineering Canada Inc. and Woodfibre LNG for specific application to the Woodfibre LNG – Floatel #2. The information and data contained herein represent **Northwest Hydraulic Consultants Ltd.'s** professional judgment in light of the knowledge and information available to **Northwest Hydraulic Consultants Ltd.** at the time of preparation and were prepared in accordance with generally accepted engineering practices.

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